10/pots

A LOCK

The present invention relates to a lock and in particular, but not exclusively, to a lock suitable for remote applications, applications where a number of authorised individuals need to be able to open the lock and where it may subsequently be necessary to seek authorisation from selected individuals without the requirement to obtain the return of a key associated with the lock.

The present inventors have identified that there is a need for a lock that is robust, can be operated by a number of individuals and which is intelligent. "Intelligent" in the sense used herein means that the lock should be able to communicate information relating to an associated key, thus possibly identifying the key operating the lock, and/or identifying different keys and controlling access in dependence on the key used and the logic programmed into the lock. The term "key" encompasses any device which has to be presented to the lock to operate it, particularly the term encompasses electronic programmable cards, sometimes referred to as "smart cards" and tokens or tags, the latter possibly being in the form of a key fob for a key ring. Such keys can communicate by wireless means for example infrared emissions, radio waves or by inductive coupling.

OUTLINE OF THE PRESENT INVENTION

According to the present invention there is provided a lock comprising: a secure housing having a first portion containing mechanical components of the lock; a second portion for receiving an electronics module; and handles mounted externally with respect to the secure housing. The electronics module comprises a power supply; electronics circuitry including an antenna and wireless transceiver circuitry capable of receiving an authorisation signal from an electronic key which is brought into close proximity to the electronics module; and a motorised actuator responsive to an authorisation signal.

The mechanical components in the first portion of the housing comprise a retaining pin which acts as a deadbolt for releasably retaining a robust bolt in position in the lock and in addition a linkage mechanism providing means for the handles under selective circumstances to be connected to the retaining pin such that movement of the handles displaces the retaining pin, appropriate selective circumstances being when an authorisation signal has been received by the transceiver circuitry of the electronics module whereby the motorised actuator interacts with the linkage mechanism so as to permit movement of the handles to displace the retaining pin.

A lock according to the invention is particularly advantageous in a remote or hostile environment. Considering for example a location for a mobile radio mast, such a site will typically comprise a perimeter fence enclosing apparatus belonging to several companies. In such an application operatives of the respective companies will need access to the site. In addition, it may also be necessary to occasionally provide access to contractors charged with the performance of specific

tasks within the site. Employing the present invention enables a common lock to be provided with any number of keys issued, each key may conveniently be in the in the form of an electronic card or tag issued to appropriate personnel. Each key, or group of keys, may have a unique code and the lock can be arranged, by programming of the electronics module, to permit selective operation of the lock depending on information encoded into the signal from the key.

The function and advantages of electronic or intelligent locks, are already known, most of which would be applicable to a lock in accordance with the present invention. These are too numerous to list here, but by way of illustration, the lock may, for example, be programmed, either by transmitting a signal to it on site, or by programming the electronic module off site, such that it may recognise only certain cards issued as being authorised, such as cards belonging to one company. Alternatively, the lock may be programmed to permit access only at certain times.

A particular advantage of having an electronic module which can be removed from the lock is that if a module needs to be reprogrammed or replaced for some reason, for example the power supply contained within that module is failing, (which power supply will normally be in the form of battery contained within the module), then the module may be arranged in the form of a secured and selectively releasable cartridge so that it can be replaced simply without removing or dismantling the lock.

A problem with an electronic lock for a remote application is that, taking the example of a perimeter fence, the lock may be remote from a power source and may be visited infrequently, thus the useful lifetime of the module will often depend on the requirement for electronic power from a power supply contained within the module. The present invention uses very little power producing only a minimal drain on the power supply of the electronic module by having a mechanism whereby it is the action of the handle that physically withdraws the retaining pin, the electronics module only enabling the release of the retaining pin.

Preferably the lock further comprises mechanical locking components which *inter alia* cooperate to releasably secure the electronics module within the secure housing, releasing means being in the form of a mechanical key. This mechanical key-operated lock arrangement enables, by means of turning the key in the lock in a first direction, the electronics module to be replaced, even after it has failed, but it is important to note that access to this electronic module release function is restricted.

It is also particularly advantageous if the same mechanical key, by virtue of being turned in a second direction in the lock, can release the retaining pin from the bolt thereby providing means to perform manual override locking and unlocking operations since these functions would also be necessary in the event of failure of the electronics module.

Further advantages may be conferred by arranging that the key-operated lock is arranged to receive a first key type, which can only turn in one direction and a second key type which can turn in the other direction or both directions, for it is then possible to have a first mechanical key type which can override the lock in the event of a failure of the electronic module and another key type which can permit both mechanical override of the locking and unlocking function and provide releasing means for the electronics module.

Locks according to the present invention may be made in various forms by directing the embodied features according to the requirements of a given environment. For instance, in an urban environment where vandalism is a recurring problem, it is particularly advantageous that the linkage mechanism only provides mechanical linkage between the handles and the retaining pin when an authorisation signal has been received. By virtue of the handles being able to "freewheel" at other times the possibility of extreme force being applied to the handle (which might otherwise damage the locking mechanism) is avoided. This arrangement also further provides the possibility that where the electronic module is normally in a power conserving 'sleep' mode, with its receiver turned off, it can be awoken by mechanical operation of the handle. This operation of the handle will first awake the electronic module and then, if an authorised electronic key is in close proximity to the receiver of the module, then the actuator of the module may permit force applied to the handle to be transmitted to the retaining pin to withdraw that retaining pin.

Even though the lock of the instant invention is very power-sparing, repeated unauthorised interference by vandals will introduce many cycles of waking the electronics module which will eventually shorten the service life of the battery. This may not be a great problem in an urban environment since maintenance schedules will compensate for any recurring issue of power drainage and the need for electronics module replacement because of battery depletion.

However, a remote environment may be hostile in a different manner in that the site may be difficult to reach or it may be simply infrequently visited. Vandalism is unlikely to be an issue here but the maximum extension of battery life is very important, as is lower power consumption, such that the duty cycle of an electronics module between changes is as long as possible. To accommodate this type of application the interaction between the handles and the retaining pin may be arranged such that only 90° of free motion of the handles is provided upon first approach, the handles springing back to the start position when released, and a magnetic switching arrangement between the electronics module and mechanical lock manages the operation of the lock.

In either form, in addition to an authorisation being necessary to permit opening of the lock, it is advantageous if on exit or if a lock-in is required, that the electronics module and mechanical components are arranged such that an authorisation signal also has to be received to permit the bolt and the retaining pin to cooperate so as to close and secure the lock. This may be accomplished by

providing the electronics module with a sensor for detecting the presence of the bolt. These features provide for the identification of the key which authorised operation of the lock and thus permit the lock to both record when the lock was opened and when it was subsequently closed, thus the electronics module of the present invention is able to store an audit trail.

Further variations may combine the lock of the instant invention with one or more wireless or other communications technologies. Such applications are important, not only for commercial reasons but also because they may assist organisations to meet existing and incoming Health and Safety Regulations. Such regulations have been in force in the UK since 1974 and the Management of Health and Safety at Work (MHSW) Regulations 1999 updated the position regarding the Lone Worker. Many other countries and the European Community have stringent policies concerning the safety of the Lone Worker.

By way of example only, the lock of the present invention may be deployed at a remote mobile telephone repeater station and be provided with a Bluetooth™ enabled device operating in the 2.4GHz band over about 10 metres or so at an extremely low power level and which would wake up only when the lock was activated. This device could communicate with another Bluetooth™ device located in the station compound which in turn could interface with, say VHF technology, to send and receive data over moderate to large distances. By these or other wireless technologies the whereabouts of employees at precise times could be established and check-in protocols would ensure that their safety status was updated regularly. In addition, many other functions could be controlled via the medium of the instant lock, including controlling variations to levels of clearance for access to sites. For instance, one worker may be entitled to access certain sites of a company or government department but not others. If a colleague failed to report for work due to illness and a replacement for his or her duties was needed urgently at a remote point, the lock at that site could be remotely programmed via a communications link such as the example immediately hereinbefore described with an updated and temporary elevation of security clearance for the replacement operative not normally able to gain access to the site. Numerous other communications protocols might be used instead including GPRS and WAP devices.

Advantageously, a dummy electronics module may be mechanically configured such that, when inserted into the second portion of the secure housing of the lock, it interacts physically with the mechanical components to allow release of the lock mechanically, thus permitting the lock to be placed in a permanent manual override position until the dummy module is replaced with a functioning electronics module.

According to a second aspect of the present invention, there is provided a non-contact key for use with the lock which may be in the form of a "smart card" or a token or a key fob attachment in the form

of a tag, in every case the key being provided with electronic circuitry means which identify its bearer to the lock with the intent of providing access only to those with appropriate permissions.

Two preferred embodiments of the present invention will now be described with reference to the accompanying figures, in which corresponding numeral series are used throughout to indicate like parts and of which:

Figures 1a and **1b** are perspective exterior views of the front and rear aspects, respectively, of a lock in accordance with two preferred embodiments of the present invention and including a view of a "smart card" key;

Figures 1c and **1d** are perspective details of the front and rear aspects, respectively, of handles of the second of the two preferred embodiments mounted on a cut away portion of a security plate and secure housing as illustrated in **Figures 1a** and **1b** and included to show means for providing a spring-back feature when handles are released;

Figure 2 is a front elevation of the first preferred embodiment of the lock of **Figures 1a** and **1b** in a locked condition with a security cover and the front secure lock housing removed and the casing of an electronics module partially cut away to reveal internal components;

Figure 3 shows a similar view to **Figure 2** but with the lock of the first preferred embodiment latched open;

Figure 4 shows a similar view to **Figure 3** with the lock of the first preferred embodiment latched open, in this view the lock is in mechanical override mode;

Figure 5 shows a front elevation of the lock of the first preferred embodiment of Figures **1a** and **1b** in a locked condition with a security cover and the front lock housing removed and the casing of an electronics module partially lifted out;

Figure 6 shows a section along the line **'4-4'** of Figure **2**;

Figure 7 is a partially exploded perspective view of an electronics module illustrating important components common to both preferred embodiments of the lock of the present invention;

Figure 8 is a front elevation of the second preferred embodiment of the lock of **Figures 1a** and **1b** in a locked condition, ready to open, with a security cover and the front lock housing removed and the casing of an electronics module partially cut away to reveal internal components;

Figure 9 shows a similar view to **Figure 8** but with the lock of the second preferred embodiment latched open and a bolt fully withdrawn;

Figure 10 shows a similar view to **Figure 9** with the lock of the second preferred embodiment locked, in this view the lock is in a "wake up" condition;

Figure 11 shows a similar view to **Figure 9** with the lock of the second preferred embodiment latched open, in this view the lock is in mechanical override mode;

Figure 12 shows a front elevation of the lock of the second preferred embodiment of **Figure 1a** and **1b** in a locked condition with a security cover and the front lock housing removed and an electronics module partially lifted out;

Referring first to **Figures 1a, 1b** and **2** through **7** there is shown a first preferred embodiment of a lock, according to the present invention, numbered generally as **1** and which is primarily intended to be used in applications and situations where the risk of vandalism or other deliberate damage is high and where battery longevity, though excellent, is slightly less than in the second embodiment hereinafter described.

In **Figures 1a** and **1b** a lock, shown generally as **1** comprises a housing **2** a first aperture **3** for receiving an integral bolt **19** handles **4a** and **4b** for actuating lock **1** and a second aperture **5** for receiving an electronics module **6**. Electronics module **6** has an antenna within casing **31** the position of which is indicated at **7**. Antenna **7** is for communicating with a non-contact electronic key preferably in the form of 'smart card' **8** having microcircuitry indicated at **8a** embedded therein for communicating with electronics module **6** by bringing it into close proximity thereto.

Lock **1**, is preferably constructed of stainless steel and optionally comprises an additional stainless steel plate which functions as a security cover **9** secured in place by a plurality of security screws **10**. Screws **10** may be any suitable commercial off-the-shelf screws having a head that requires a special tool to release them. Security cover plate **9** obscures the position of a mechanical cylinder lock **11** the function of which is described hereinafter and therefore security cover plate **9** hides a potential 'soft spot' of lock **1**. For additional security, steel cover plate **9** may be secured from within housing **2** using screws **10** only on the inward facing or locked area facing of lock **1**. For the absence of doubt it is to be understood that the intention is to place screws facing into a locked area which the lock is securing and to present a plain cover to the outside.

Referring to the elevation of **Figure 2** this shows lock **1** with security cover plate **9** and the front of housing **2** removed and casing **31** of electronics module **6** partially cut-away along double-dash-triple-

dot line 'X'. Housing 2 comprises a first portion 2a having mechanical components housed therein and a second portion 2b in which electronics module 6 is located.

Electronics module 6 may be seen in more detail by brief reference to Figures 5 and 7. Electronics module 6 houses a substantial battery pack 12 which may be of any convenient type having the properties of longevity and robust reliability, a motorised actuator 13 and modular circuitry which may conveniently be a PIC or ASIC package 14 having antenna, transceiving, optional separate communications circuitry, encoding, decoding and control elements. Electronics module 6 is retained within housing 2 against resilient block 15 by latch 16 engaging recess 32.

The mechanical components of lock 1 in first portion 2a of housing 2 comprise a bolt-retaining pin 17 biased by spring 18 to the engaged position within deadlock recess 19a shown in Figure 2 whereby it retains bolt 19 in the extended, locked position of lock 1. Bolt 19 locates and travels in not only housing 2 but also in housing extension 20. Housing extension 20 has a slot 47 and bolt 19 has an operating pin 48 extending completely through bolt 19 and extending out through slot 47. Under appropriate conditions this enables an operative to manually throw bolt 19 from a retracted position, within lock 1 to an extended position, by moving operating pin 48 along the full extent of slot 47 of housing extension 20. Extended bolt 19 may engage a recess in the same manner as a mortise lock, and vice versa. However, although in this embodiment this arrangement is preferred, it will be apparent to those skilled in the art that bolt 19 may be arranged in many different ways. For instance, housing extension 20 could be omitted and slot 47 could be accommodated directly in secure housing 2 though with some loss of vandal-proofing.

The other principal components are comprised in a linkage mechanism illustrated generally as 21 and described hereinafter with reference to Figures 2 to 7. In addition, there are two latching slides 22 and 23 each being provided with clearance openings 22a and 23a respectively. The function of clearance openings 22a and 23a is to allow retaining pin 17 to pass through into deadlock recess 19a of bolt 19 when aligned therewith such as occurs when lock 1 is desired, and duly authorised, to be locked closed or unlocked. At other times, latching slides 22 and 23 present solid metal under retaining pin 17 which thus cannot then pass through into deadlock recess 19a.

Referring to Figure 6 which is a sectional view along line '4-4' of Figure 2, this shows some important aspects of the linkage mechanism 21 especially the manner in which it is supported by shaft 24 extending between handles 4a and 4b located on either side of housing 2. As may be best seen in Figures 2, 3, 4 and 5 linkage mechanism 21 comprises a paddle wheel 25 and dog clutch 26 engageable by pawl 27. Paddle wheel 25 and dog clutch 26 are physically connected to handles 4a and 4b. Linkage mechanism 21 additionally comprises a bushed driven plate 28 to which pawl 27 is attached. Bushed driven plate 28 has an engagement surface 29 for contacting pin 30 extending from retaining pin 17 as may be seen, for instance, by brief reference to Figures 2 and 3.

Referring now to **Figure 7** motorised actuator **13** is located in electronic module **6** which also has a recess **32** in casing **31** by means of which it is retained in position via latch **16**. Motorised actuator **13** has a shaft **34** providing mounting means for gear **33** which acts on opposing racks **39** and **40** in the direction of arrows **'A'** and **'B'**. As may be seen by reference to **Figure 7** rack **39** has a captive guide **39a** provided with a buffer spring **39b**. These elements cooperate to interact with slide **22** whilst rack **40** has a driving face **37** which interacts with spring **35** which is pivoted on pin **36** to selectively drive pawl **27** against captive pawl spring **27a**. Captive pawl spring **27a** maintains a biasing force against pawl **27** tending to disengage it from dog clutch **26** and this condition prevails until passing contact with spring **35** overcomes the effect of spring **27a**.

Electronic module **6** additionally comprises two sensors **41** and **42**. First sensor **41** is a reed switch and detects the presence of magnet **43** located on bolt **19** when it is thrown fully home locking lock **1**. Sensor **42** is a sensor that detects movement of paddle wheel **25** by detecting the movement of magnets **25a** to **25d** retained in paddle wheel **25** as they pass window **38** in housing **2**.

Describing now the operation of the first preferred embodiment of the instant lock, lock **1** is installed on a gate or door or the like, that it is desired be secured. Lock **1** is installed in a position such that bolt **19** can be received slidably into a suitable locking aperture. Authorised personnel on approaching lock **1** rotate handle **4a**, and simultaneously present a key in the form of an electronic smart card or tag **8** to lock **1** so that it is in close proximity to antenna **7** of electronic module **6**.

As may be seen variously from **Figures 2** through **6** rotation of handle **4a**, will cause paddle wheel **25**, to rotate and magnets **25a** to **25a** to pass by sensor **42** which detects the movement and sends signals to circuitry package **14** within electronics module **6** to "wake up" its integral transceiver. At this stage, handles **4a** and **4b** are is free to rotate, there being no connection between bushed driven plate **28** and handles **4a** and **4b**.

In response to transceiver element of **14** receiving an authorisation signal from key **8** via antenna **7** control circuit element of electronic package **14** controls motorised actuator **13** to drive rack **40** of **Figure 7**. As may be seen with reference to **Figure 2** driving face **37** of rack **40** makes driving contact with spring **35** which is driven into contact with pawl **27** overcoming the disengagement bias of captive pawl spring **27a** and causing engagement of pawl **27** with dog clutch **26**. When pawl **27** engages dog clutch **26** further rotation of handle **4** causes retaining pin **17** to be withdrawn from bolt **19** until it is in the raised position shown in **Figure 3**.

With continuing reference to **Figure 3** when retaining pin **17** is withdrawn, lock **1** is in a condition for bolt **19** to be thrown into extension. Retaining pin **17** has been raised through clearance openings **22a** and **23a** and is latched into the raised position by slides **22** and **23** which are urged into the positions shown by the action of spring **44**.

When lock 1 is in the open position (**Figure 3**), and it is desired to re-lock lock 1 an authorised operative "wakes up" the transceiver circuitry of electronics package **14** of electronic module **6** by the mechanical operation of **4a** and **4b** which action presents magnets **25a** to **25a** to sensor **42**. If transceiver circuitry of **14** detects the presence of an authorised key **8** it then sends a signal causing motorised actuator **13** to move racks **39** and **40** in the direction of arrow **'A'** of **Figure 2**. When bolt **19** is extended from aperture **3** the movement displaces slide **23** and subsequently slide **22** permitting retaining pin **17** to drop through clearance openings **22a** and **23a** which are aligned thereunder and engage bolt deadbolt recess of bolt **19**. It is to be noted that if an authorisation signal has not been received, then rack **39** will still be in the position indicated by arrow **'B'** in **Figure 3**. Slide **22** will thus be prevented from moving in a direction to the left of **Figure 2** or **3** and thus clearance openings **22a** and **23a** will not be aligned with retaining pin **17** which therefore will not drop and engage bolt **19**.

Circuitry within package **14** of electronic module **6** logs both the opening and closing of lock 1 identifying both the time and the identity of the card key **8** that caused lock 1 to be opened or closed. In addition, circuitry within electronics package **14** of electronic module **6** could also log mechanical functions.

If electronic module **6** should fail, or it is desired to replace electronic module **6** security cover plate **9** is removed and a mechanical key (not illustrated) is inserted into mechanical lock **11**. Rotation of a mechanical key in a first direction causes locking bar **45** to engage latch **16** releasing it from recess **32** in electronic module **6**. Rotation of the mechanical key anticlockwise, causes locking bar **45** to act against pin **46** as may be best seen in **Figure 4**, withdrawing retaining pin **17** from bolt **19** and thereby releasing bolt **19**.

When it is desired or necessary for maintenance or management purposes to remove electronic module **6** a dummy replacement module (not illustrated) containing no electronics, may be placed in portion **2b** of housing **2** of lock 1. Such a dummy module would have an appropriate driving face, structurally equivalent to **37** to engage with pawl **27** but not slide **22**. This allows lock 1 to operate manually without the need to operate manual cylinder lock **11**. A variant dummy module can also be provided which does not have a driving face and which also is not provided with means to engage slide **22**. This module would place lock 1 into a key-operated mode.

Referring now to **Figures 1a – 1d** and **7** through **12** there is shown a second preferred embodiment of a lock according to the present invention, numbered generally as 100 and which is primarily intended to be used in applications and situations where the risk of vandalism or other deliberate damage is relatively low but where isolation and climatic hostility demand the greatest possible battery longevity.

In the first preferred embodiment hereinbefore described, handles **4a**; **4b** on shaft **24** revolve 360° and this important feature imparts maximal defence against any attempt to destroy the lock by an act

of vandalism since, until engaged in drive mode handles **4a**; **4b** and shaft **24** 'freewheel'. However, in this second preferred embodiment the arrangement of components potentially consumes less battery power, thereby extending the life of the battery and this confers considerable advantages in remote locations and where vandalism is unlikely to be an issue. The only significant differences between the first and second preferred embodiments reside in the mechanical components housed in portion **102a** of housing **102a** in comparison to those in portion **2a** of housing **2** electronics module **106** differing only slightly from electronics module **6**.

As may be seen with reference to **Figures 1c** and **1d** in this embodiment, handles **104a**; **104b**, may be rotationally displaced, with shaft **124** to a limit, in this case, of 90°. Springs **149** and **150** retained in arcuate slots **151** and **152** located in the rear surface of handles **104a**; **104b** and disposed symmetrically with respect to the principal axis of shaft **124** cooperate with posts **153** and **154** extending from the face of housing **102**. Springs **149** and **150** provide sufficient counter-torque to cause handles **104a**; **104b** and shaft **124** when released, to spring back to the original starting or zero position.

With general reference to **Figures 8** through **12** it may be seen that in this second preferred embodiment there is provided mechanical lock **111**. Mechanical lock **111** is comprised of five major mutually cooperating components directed to two principal purposes. A first component, latch **116** engages with recess **132** directed to the purpose of removably securing electronics module **106** within portion **102b** of housing **2**.

A second component, double crank **155** has a first slide **156** which engages a drive pin **157** mounted high on retaining pin **117** and illustrated in hidden detail. Second slide **158** of double crank **155** engages a pivot pin **159** which also provides pivotal mounting means for a third component, short magnet mounting plate **160** upon which is mounted magnet **161**.

A fourth component is magnet swing plate **162** which provides mounting means for another magnet **163** and an extension of it **162a** may additionally engage a driven pin **164** on a pawl mount **165**. The fifth component is locking plate **145** which though more complex in action is analogous to locking bar **45** of the first embodiment.

With particular reference now to **Figure 8** there is shown a lock **100** in accordance with a second embodiment of the present invention, generally similar to the first embodiment in many respects, however pawl **127** is borne on pawl mount **165** and is biased in this embodiment by a captive saddle spring **127a**. Pawl **127** and dog clutch **126** are effectively reversed in comparison with the first preferred embodiment and these features may be readily compared to their respective counterparts **27** and **26** of the first embodiment by brief reference to, say, **Figure 3**. In **Figure 8** it may be seen that bolt **119** is in a locked condition with retaining pin **117** engaged through clearance openings **122a**

and **123a** into deadlock recess **119a** and with sensor **141** for sensing bolt status positioned close to magnet **143**. Sensor **141** is a reed switch which closes when in proximity to magnet **143**. Racks **139** and **140** have been activated such as would be the case just after a smart card **108** had been presented to ready lock **100** for unlocking. If either of handles **104a** or **104b** is turned whilst this 'active' condition obtains, pawl **127** will be driven into dog clutch **126** under the influence of spring **135**. Spring **135** has a safety function in that its compressibility prevents damage to lock **100** if handles **104a** or **104b** are operated abusively.

Figure 10 shows a 'wake up' condition. In this embodiment, paddle wheel **125** is connected to shaft **124** and thus connected also to handles **104a** and **104b** which are rotated anti-clockwise. This action will cause magnet **163** to close reed switch **142** initiating power supply to the circuitry of electronics package **114** within electronic module **106** producing a brief timed 'on' condition. Pawl **127** at this stage, does not drive dog clutch **126** as rack **140** and spring **135** both remain in a neutral position. In this condition, paddle wheel **125** together with handles **104a**; **124b** on shaft **124** will, upon release, spring back to neutral position under the action of springs **149** and **150**. In **Figure 10** retaining pin **117** is engaged through clearance openings **122a** and **123a** with deadlock recess **119a** of bolt **119** and this condition also obtains in **Figure 8**. It will be noted that when bolt **119** is brought into this condition, drive pin **157** acts upon double crank **155** causing short magnet mounting plate **160** to swing around pivot **159** so as to bring magnet **161** close to reed switch sensor **166**. Raising bolt **119** reverses these actions and it will be appreciated that these components cooperate to provide means for sensing the status of retaining pin **117** to the circuitry of electronics package **114** of electronics module **106**. This provision is not made in the first preferred embodiment.

If circuitry within electronics package **114** is then activated by smart card **108** then as may be seen in **Figure 9** rack **140** is driven by motorised actuator **113** against spring **135** which drives pawl **127** into engagement with dog clutch **126** overcoming captive saddle spring **127a**. **Figure 9** shows paddle wheel **125** rotated anti-clockwise by shaft **124** driving dog clutch **126** via pawl **127** thereby lifting and disengaging retaining pin **117** from bolt **119**. In **Figure 9** bolt **119** is shown in the withdrawn position. The status of bolt **119** is sensed by magnet **143** being displaced from reed switch **141** which is in an open condition. The elevated status of retaining pin **117** is sensed by the pivotal displacement of magnet **161** away from proximity with reed switch sensor **166** which is achieved by driving cooperation between drive pin **157** of retaining pin **117** which drives double crank **155** such that second slide **158** causes short magnet mounting plate **160** to pivot anti-clockwise about pivot **159**.

Figure 10 shows a 'timed-out' or idle condition with pawl **127** disengaged from dog clutch **126**; lock **100** can be "woken up" from this position by rotation of handles **104a**; **104b**.

Figure 11 shows a locked open condition. With retaining pin **117** raised, bolt **119** has been withdrawn. Racks **139** and **140** are wide open causing captive slide **139a** of rack **139** to remain in the

path of slide **123**. This condition thereby prevents slides **122** and **123** from being urged out of the path of **117** with the result that slides **122** and **123** cannot present openings **122a** and **123a**, respectively, for retaining pin **117** to pass through.

Figure 12 is analogous to **Figure 5** of the first preferred embodiment in that it shows electronics module **106 (6)** in a partly removed condition with respect to secure housing **102 (2)**.

Although two embodiments of the present invention have been illustrated with reference to the accompanying figures, it will be evident to one skilled in the art that many modifications or alternative arrangements of the lock will be apparent to one skilled in the art, which alternative arrangements will be within the scope of the following claims.